Meridian 1

Intelligent peripheral equipment circuit cards for Holland

Option 11 - Description and Installation

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About this document

This document is a Supplement to the Option 11 *Installation guide (553-3011-210). It describes the functions and applications of the following circuit cards that are available for use in Holland:*

- NTAG03AA Central Office Trunk card
- NTAG04AA Central Office/Direct Inward Dial Trunk card
- NT5K83DB E&M/L1 Tie Trunk card
- NT5K02KA Flexible Analog line card
- NT5K96KA Flexible Analog line card.

Central office trunk circuit card

Functional description

The NTAG03AA Central Office trunk card provides the interface between the Option 11 system and up to eight analog Central Office (CO) trunks. It can be installed in slots 1-10 in the Option 11 main cabinet and in any slot in the expansion cabinet.

Common features

The NTAG03AA Central office trunk card:

- supports A-type signaling and 50 Hz Periodic Pulse Metering (PPM) detection
- receives tone detection information from the Tone Detector card
- provides busy tone detection (far end release)
- allows trunk type to be configured on a per unit basis
- provides disabling of individual units or the entire card through software
- indicates self-test status during an automatic or manual self-test
- converts transmission signals from analog-to-digital and from digital-to-analog
- provides 600 ohm terminating impedance in compliance with regulatory Holland standards
- provides complex balance impedance in compliance with regulatory Holland standards.

Physical description

Measurements

Each NTAG03AA Central office trunk card measures as follows:

Height:	318 mm (12.5 in.)
Depth:	254 mm (10 in.)

Switch settings

There are no option settings on the NTAG03AA Central office trunk card. All settings are configured in software.

Connections

The NTAG03AA Central office trunk card has eight units. Each trunk unit on the card connects to the backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel, and the I/O panel is cabled to the cross-connect terminal. At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Hardware installation

Table 1 provides cross connect information for the NTAG03 Central Office Trunk card.

Table 1
NTAG03 Central Office Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
	27 2	W-O O-W	
T1 R1	28 3	W-G G-W	Unit 1
	29 4	W-BR BR-W	
T2 R2	30 5	W-S S-W	Unit 2
	31 6	R-BL BL-R	
T3 R3	32 7	R-O O-R	Unit 3
	33 8	R-G G-R	
T4 R4	34 9	R-BR BR-R	Unit 4
	35 10	R-S S-R	
T5 R5	36 11	BK-BL BL-BK	Unit 5
	37 12	BK-O O-BK	
T6 R6	38 13	BK-G G-BK	Unit 6
	39 14	BK-BR BR-BK	
T7 R7	40 15	BK-S S-BK	Unit 7
	41 16	Y-BL BL-Y	

Self-test

When the card is installed, the red Light Emitting Diode (LED) on the faceplate flashes as the self-test runs. If the self-test completes successfully, the card is automatically enabled (if it has been configured in software) and the LED goes out. If the self-test fails, the LED will remain lit. The LED will also remain lit if one or more units on the card become disabled while the card is operating.

Trunk configuration

Route Data Block

Each trunk unit on the NTAG03AA central office trunk card is attached to a route with an associated route data block. Trunk timers are configured on a route basis.

Note: All prompts are defaulted except for those noted in Table 2. Default values are shown in brackets.

Table 2
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-511	Enter route number
TKTP	COT	Define trunk type as central office
ICOG	IAO	Incoming and Outgoing trunk
ACOD	XXXXXXX	Trunk route access code
CNTL	YES	Change a trunk timer
TIMER	RGV 256	Ring Validation Timer = 256 ms
DTD	YES	Dial tone detector performed on this route
—Table continued—		

Prompt	Response	Comments
2DT	YES	
SCDT	NO	Secondary dial tone is not used in Holland
XTDT	(0)-7	Extended tone detector table number programmed in overlay 97 (Enter 0 if the table has not already been programmed in LD 97)
NEDC	ETH	Near end disconnect control from either end
FEDC	ETH	Far end disconnect control from either end
MR	PPM	Buffered PPM signals counted on this route

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NTAG03AA central office trunk. Default values are shown in brackets in Table 3.

Table 3
LD 14 Route Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	COT	Central Office Trunk
TN	CC UU	Terminal number of the unit: Card, Unit
CDEN	(8D)	Card density is 8D (default)
XTRK (see note)	XCOT	Type is IPE COT
SIGL	LOP	Loop Start signaling
PPID	07	PPM country Identification
BTID	07	Busy Tone country identification
CLS	DTN, (DIP) BTS	Digitone signaling, (Digipulse) Battery supervision enabled, (disabled)

Note: This prompt is required only for the first unit defined on each NTAG03AA card.

Technical description

Power requirements

Table 4 provides the power requirements for the NTAG03AA Central office trunk card.

Table 4
NTAG03AA Power requirements

Voltage	Active current
+15.0 V dc (see note 1	400 ma
- 15.0 V dc (see note 1)	300 ma
+ 8.5 V dc (see note 2)	160 ma
+ 5.0 V dc	330 ma

Note 1: Analog circuitry is powered with +/- 12V generated from +/- 15V.

Note 2: 8.5V is regulated to provide 5V.

Environmental specifications

Table 5 provides the environmental specifications for the NTAG03AA central office trunk card.

Table 5
NTAG03AA environmental specifications

Parameter	Limit
Operating temperature	0 to 40 degrees C, ambient
Operating humidity	10 to 95% relative humidity
Storage temperature	-45 to +70 degrees C
Storage humidity	10 to 95% relative humidity

Transmission parameters

Pad settings are not required in Holland. Loss values for the NTAG03AA Central office trunk card are as follows:

Analog to Digital loss:-6.5 dB (plus or minus 0.5 dB)

Digital to Analog loss:+0.5 dB (plus or minus 0.5 dB)

Trunk types description

Each NTAG03AA Central office trunk card supports:

- Loop start operation
- Busy tone detection and disconnect clearing (call disconnect)
- 50 kHz Periodic Pulse Metering (PPM)

A-type signaling

Each unit on the NTAG03AA card supports A-type signaling for incoming and outgoing central office calls.

Idle state

In the idle state, the central office trunk card provides a high impedance loop (greater than 50 K ohms) toward the central office for isolation and dc detection. The maximum capacitance of the central office trunk card is 1.1 µF.

Call placed by central office

The Central Office initiates a call by applying ringing between the tip and ring leads. If the call is not answered after 15 seconds, a timeout occurs: the central office returns to the standby condition and the Option 11 returns to the idle state.

Answer

The Option 11 answers a call by placing a speech loop across the tip and ring leads. This speech loop is maintained for at least 300 milliseconds.

Call placed by Option 11

To initiate a call, the Option 11 switches out the ringing detector and places a low resistance loop across the tip and ring leads.

Dialing

If the dial tone detect feature is enabled in LD 16, dialing does not occur until the NTAG03AA card detects dial tone from the central office. Then, digits are sent in the form of Dual Tone Multifrequency (DTMF) tones or decadic digits.

Automatic dialing equipment, with the help of software, will wait for dial tone from the central office for a minimum of 5 seconds, and a maximum of 40 seconds. If dial tone is not detected after 40 seconds, clear down occurs.

Central office disconnect

The central office disconnects a call by applying busy tone toward the Option 11. If the central office trunk card is configured to detect busy tone, it will disconnect the call.

Option 11 disconnect

The Option 11 disconnects the call by removing the loop between the tip and ring leads and replacing it with a high impedance loop.

Features description

Periodic Pulse Metering (PPM)

The central office applies a 50 Hz longitudinal signal to the tip and ring leads at the start and stop of each call or during a call. All trunk units on the NTAG03AA card can be individually configured to detect the 50 Hz signal.

Periodic Pulse Metering allows the user of a telephone on a Option 11 to keep an accurate record of central office calls for billing or administration purposes.

For more information on PPM, refer to *Generic X11 Including Supplementary Features appendix 2 to 553-2311-105.*

Central office/Direct Inward Dial trunk circuit card

Functional description

The NTAG04AA Central office/Direct Inward Dial (CO/DID) trunk card provides the interface between the Option 11 system and up to 8 analog trunks. It can be installed in slots 1-10 in the Option 11 main cabinet and in any slot in the expansion cabinet.

The NTAG04AA CO/DID trunk card has 8 units, each of which can be individually configured as:

- Central office incoming/outgoing trunk
- Direct Inward Dial/Direct Outward dial trunk

Common features

The NTAG04AA CO/DID trunk card:

- supports ALS B1 and B2 signaling and 50 Hz Periodic Pulse Metering (PPM) detection
- detects the polarity of the central office line
- detects incoming digipulses and sends a message to the central processing unit (CPU) for each digit
- allows trunk type to be configured on a per unit basis
- provides disabling of individual units or the entire card through software

- indicates self-test status during an automatic or manual self-test
- converts transmission signals from analog-to-digital and from digital-to-analog
- provides 600 ohm terminating impedance in compliance with regulatory Holland standards
- provides complex balance impedance in compliance with regulatory Holland standards.

Physical description

Measurements

Each NTAG04AA CO/DID trunk card measures as follows:

Height:	318 mm (12.5 in.)
Depth:	254 mm (10 in.)

Switch settings

There are no option settings on the NTAG04 CO/DID trunk card. All settings are configured in software.

Connections

The NTAG04AA Central office/Direct Inward Dial trunk card has eight units. Each trunk unit on the card connects to the backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel, and the I/O panel is cabled to the cross-connect terminal. At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Hardware installation

Table 1 provides cross connect information for the NTAG04AA CO/DID Trunk card.

Table 6
NTAG04 CO/DID Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
	27 2	W-O O-W	
T1 R1	28 3	W-G G-W	Unit 1
	29 4	W-BR BR-W	
T2 R2	30 5	W-S S-W	Unit 2
	31 6	R-BL BL-R	
T3 R3	32 7	R-O O-R	Unit 3
	33 8	R-G G-R	
T4 R4	34 9	R-BR BR-R	Unit 4
	35 10	R-S S-R	
T5 R5	36 11	BK-BL BL-BK	Unit 5
	37 12	BK-O O-BK	
T6 R6	38 13	BK-G G-BK	Unit 6
	39 14	BK-BR BR-BK	
T7 R7	40 15	BK-S S-BK	Unit 7
	41 16	Y-BL BL-Y	

Self-test

When the card is installed, the red Light Emitting Diode (LED) on the faceplate flashes as the self-test runs. If the self-test completes successfully, the card is automatically enabled (if it has been configured in software) and the LED goes out. If the self-test fails, the LED will remain lit. The LED will also remain lit if one or more units on the card become disabled while the card is operating.

Central office trunk configuration

Route Data Block

Each trunk unit on the NTAG04AA central office/Direct Inward Dial trunk card is attached to a route with an associated route data block. Trunk timers are configured on a route basis.

Note: All prompts are defaulted except for those noted in Table 2-2. Default values are shown in brackets.

Table 7
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-511	Enter route number
TKTP	COT	Define trunk type as central office
ICOG	IAO	Incoming and Outgoing trunk
ACOD	XXXXXXX	Trunk route access code
CNTL	YES	Change a trunk timer
TIMER	DSI 2048	Disconnect Supervision Timer =2048 ms
	GTI 512	Incoming Guard Timer = 512 ms
	GTO 512	Outgoing Guard Timer = 512 ms
	RGV 256	Ring Validation Timer = 256 ms
— Continued —		

Prompt	Response	Comments
DTD	YES	Dial tone detector performed on this route
2DT	YES	
SCDT	NO	Secondary dial tone is not used in Holland
XTDT	(0)-7	Extended tone detector table number programmed in overlay 97 (Enter 0 if the table has not already been programmed in LD 97))
NEDC	ETH	Near end disconnect control from either end
FEDC	ETH	Far end disconnect control from either end
MR	PPM	Buffered PPM signals counted on this route

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NTAG04AA CO/DID trunk. Default values are shown in brackets in Table 3.

Table 8
LD 14 Route Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	COT	Central Office Trunk
TN	CC UU	Terminal number of the unit: Card, Unit
CDEN	(8D)	Card density is 8D (default)
XTRK (see note)	XCOT	Type is IPE COT
SIGL	ALS	ALS signaling
PPID	07	PPM country Identification
CLS	DTN, (DIP)	Digitone signaling, (Digipulse)

Note: This prompt is required only for the first unit defined on each NTAG04AA card.

Direct Inward Dial trunk configuration

Route Data Block

Each trunk unit on the NTAG04AA central office/Direct Inward Dial trunk card is attached to a route with an associated route data block. Trunk timers are configured on a route basis.

Note: All prompts are defaulted except for those noted in Table 4. Default values are shown in brackets.

Table 9
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
— Continued —		

Prompt	Response	Comments
ROUT	0-511	Enter route number
TKTP	DID	Define trunk type as Direct Inward Dial
ICOG	IAO	Incoming and Outgoing trunk
ACOD	XXXXXXX	Trunk route access code
CNTL	YES	Change a trunk timer
TIMER	DSI 2048 GTI 512 GTO 512 RGV 256	Disconnect Supervision Timer = 2048 ms Incoming Guard Timer = 512 ms Outgoing Guard Timer = 512 ms Ring Validation Timer = 256 ms
DTD	YES	Dial tone detector performed on this route
2DT	YES	
SCDT	NO	Secondary dial tone is not used in Holland
XTDT	(0)-7	Extended tone detector table number programmed in overlay 97 (Enter 0 if the table has not already been programmed in LD 97))
NEDC	ETH	Near end disconnect control from either end
FEDC	ETH	Far end disconnect control from either end
MR	PPM	Buffered PPM signals counted on this route
PRDL	YES	Partial timing equipped using EOD
EOS	YES	End of Selection signal enabled
ACKW	YES	Seizure acknowledgment signal is expected after seizure of a DID/-DOD trunk

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NTAG04AA CO/DID card. Default values are shown in brackets in Table 5.

Table 10
LD 14 Route Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	COT	Central Office Trunk
TN	CC UU	Terminal number of the unit: Card, Unit
CDEN	(8D)	Card density is 8D (default)
XTRK (see note)	XCOT	Type is IPE COT
SIGL	EAM	E&M signaling
STRI	IMM	Incoming start immediate
STRO	IMM	Outgoing start immediate
SUPN	YES	Answer and disconnect supervision
PPID	07	PPM country Identification
CLS	DTN, (DIP) BARD	Digitone signaling, (Digipulse) Barring denied
DTCR	YES, (NO)	Digit collection ready. Set to YES only if class of service (CLS) is digitone (DTN).

Note: This prompt is required only for the first unit defined on each NTAG04AA card.

Technical description

Power requirements

Table 6 provides the power requirements for the NTAG04AA Central office/Direct Inward Dial trunk card.

Table 11
NTAG04AA Power requirements

Voltage	Active current
±15.0 V dc (See note 1)	500 ma
+ 8.5 V dc (see note 2)	160 ma
- 48.0 V dc	0 ma
+ 5.0 V dc	350 ma

Note 1: Analog circuitry is powered with +/- 12V generated from +/- 15V.

Note 2: 8.5V is regulated to provide 5V.

Environmental specifications

Table 12
NTAG04AA Environmental specifications

Parameter	Limit
Operating temperature	0 to 40 degrees C, ambient
Operating humidity	10 to 95% relative humidity
Storage temperature	-45 to +70 degrees C
Storage humidity	10 to 95% relative humidity

Transmission parameters

Pad settings are not required in Holland. Loss values for the NTAG04AA Central office/Direct Inward Dial trunk card are as follows:

Analog to Digital loss:-6.5 dB (plus or minus 0.5 dB)

Digital to Analog loss:+0.5 dB (plus or minus 0.5 dB)

Trunk types description

The NTAG04AA trunk card can be configured as a central office trunk or as a Direct Inward Dial trunk.

Each unit on the NTAG04AA CO/DID card meets ALS-70 signaling requirements. ALS-70 signaling has the following characteristics:

- the central office changes state by reversing the polarity of the central office line
- the trunk unit changes state by changing the loop resistance presented to the central office.

ALS-70 signaling for central office (B1) and DID/DOD (B2) trunks is described in the following sections.

Central office trunk and Direct Inward Dial operation (ALS-70 B1 and B1 signaling)

Idle state

In the idle state, the central office is the standby condition (tip wire positive with respect to the ring wire). The Option 11 presents a high impedance loop to the central office.

Call placed by central office—Central office trunk operation only

The central office places an incoming call by changing the polarity of the tip and ring leads.

Call placed by central office—Direct Inward Dial operation only

The central office places an incoming call by changing the polarity of the tip and ring leads. If direct dialing occurs, then "proceed to send" and "number received" signals are exchanged between the Option 11 and the central office.

Proceed to send

If class of service is digitone, the Option 11 sends a "proceed to send" signal to the central office by switching to the speech impedance loop. (A digitone receiver must be available, and the DTCR prompt must be set to YES in overlay 14). The "proceed to send" signal tells the central office that the Option 11 is ready to receive dialing information.

Incoming digits can be digipulse or dual tone multifrequency (DTMF). In the case of DTMF digits, the "proceed to send" signal will not be sent until a digitone receiver has been assigned to the trunk unit.

Number received
The Option 11 sends a "number received" signal to the central office by switching to a low impedance loop. This signal tells the central office that all dialing information has been received or no more information can be accepted.

If the called number is free, the Option 11 returns a ringing signal until the call is answered or forwarded.

If the called number is busy, the Option 11 will do one of three things:

- forward the call to another extension
- forward the call to the attendant console
- send busy tone to the central office until it clears the call.

Answer

When a call is answered, the Option 11 presents a speech loop impedance to the central office. This speech loop is maintained for a minimum 300 milliseconds.

Call placed by Option 11

The Option 11 places an outgoing call by establishing a speech loop across the tip and ring wires. This action does not automatically busy the trunk circuit against outgoing calls since incoming calls are given priority. The central office can seize the circuit for up to 200 ms after Option 11 seize.

Proceed to send
When the central office is ready to receive address information, it sends a "proceed to send" signal by returning dial tone. The Option 11 then sends digitone or digipulse digits.

> ***Note:*** The Option 11 will detect dial tone only if a dial tone detector is configured for that route.

End of selection
The central office sends an "end of selection" signal by reversing polarity on the central office line. This signal informs the Option 11 that either all addressing information has been received or that no more information can be accepted.

The Option 11 responds to the signal within 10 to 100 milliseconds by placing a speech impedance loop across the tip and ring leads and by cutting through the speech path.

Option 11 disconnect

The Option 11 disconnects a call by replacing the speech impedance loop with a low impedance loop (clear back signal). The central office interprets this signal as a request to end the call. The central office ends the call by returning to the standby condition. The Option 11 responds by returning to the high impedance loop state.

The Option 11 can cancel a request for cleardown if it returns to the speech impedance loop before the 100 millisecond time interval expires.

Central office disconnect

The central office disconnects a call by reversing polarity on the tip and ring leads and returning to the standby condition. At this time, congestion tone is applied toward the Option 11. The Option 11 responds within 6 seconds by returning to the high impedance loop state.

Features description

Periodic Pulse Metering (PPM)

The central office applies a 50 Hz longitudinal signal to the tip and ring leads at the start and stop of each call or during a call. All trunk units on the NTAG04AA card can be individually configured to detect the 50 Hz signal.

Periodic Pulse Metering allows the user of a telephone on a Option 11 to keep an accurate record of central office calls for billing or administration purposes.

For more information on PPM, refer to *Generic X11 Including Supplementary Features appendix 2 to 553-2311-105.*

Restricted DID class of service

The restricted class of service feature designates certain stations as RDI stations, meaning they are fully restricted and cannot receive DID calls.

DID to Tie connection

When "end of dialing" is detected on an outgoing Tie trunk, a CFNA (call forward no answer) timer is set. If the call is not answered before the timer runs out, the tie trunk is disconnected and the attendant intercepts the call.

E&M tie trunk circuit card

Functional description

The NT5K83DB E&M Tie trunk card provides the interface between the Option 11 system and up to four analog trunks. It can be installed in slots 1-10 in the Option 11 main cabinet and in any slot in the expansion cabinet.

The NT5K83DB E&M Tie trunk card supports four analog trunks. Each trunk circuit can be individually configured as:

- 2-wire E&M BPO (Type V)
- 4-wire E&M Type I, Type II, BPO (Type V)
- 2280 Hz Tie trunk
- CEPT L1 supported from release 20 onward
- Recorded Announcement (RAN) trunk
- Paging (PAG) trunk
- Music (Mus) trunk

Common features

The NT5K83DB E&M Tie trunk card:

- Analog to digital and digital to analog conversion for 4 audio paths
- Allow trunk type to be configured via Service change on a per channel basis
- Software selectable A/μ Law operation

- Provide indication of board status via the faceplate mounted LED
- Provide for disabling of individual units or the entire board under software or XPEC control
- Provide outpulsing on-board, the make break ratios will be software down-loadable in the initial configuration stage.
- Provides indication of card status on the faceplate LED
- Allows trunk type to be configured on a per unit basis in software
- Provide Termination against 600 ohms for 4 wire and CEPT L1 E&M trunk circuits.
- Provide Termination and Transhybrid Balance matching against 600 ohms for 2wire E&M trunk circuits
- Provide Flexible transmission for various Loss plans using the B34 Codec
- Provides paging (PAG), recorded announcement (RAN), and music (MUS) interfaces.
- Provide CEPT L1 signaling.\

Physical description

Switch settings

There are four switch settings on the NT5K83DB circuit card, one for each trunk unit. The switches are used to select Type V E&M signaling. (Type I and Type II E&M are selected in software).

Note: In order for Type V signaling to work, the TYP prompt in LD 14 must be set to TY1.

Table 13
NT5K83 E&M Trunk card switch settings

Signaling	Switch Setting (J1.x) Pins 1-2	Pins 2-3
4-wire Type II 4-wire Type I 2-wire Type I CEPT L1 RAN MUS PAG	Closed	Open
4-wire Type V (BPO) 2-wire Type V (BPO)	Open	Closed

Connections

Each unit on the E&M card connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal. At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Hardware installation

Tables 2 to 8 provide cross connect information for the NT5K83DB E&M Trunk card.

Table 14
NT5K83 E&M 2-wire Type 1 and type 5 (BPO) Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	27 2	W-O O-W	Unit
E M	28 3	W-G G-W	0
T1 R1	31 6	R-BL BL-R	Unit
E M	32 7	R-O O-R	1
T2 R2	35 10	R-S S-R	Unit
E M	36 11	BK-BL BL-BK	2
T3 R3	39 14	BK-BR BR-BK	Unit
E M	40 15	BK-S S-BK	3

Table 15
NT5K83 E&M 2-wire Type 2 Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	27 2	W-O O-W	
E1 E2	28 3	W-G G-W	Unit 0
M1 M2	29 4	W-G G-W	
T1 R1	31 6	R-BL BL-R	
E1 E2	32 7	R-O O-R	Unit 1
M1 M2	33 8	R-G G-R	
T2 R2	35 10	R-S S-R	
E1 E2	36 11	BK-BL BL-BK	Unit 2
M1 M2	37 12	BK-O O-BK	
T3 R3	39 14	BK-BR BR-BK	
E1 E2	40 15	BK-S S-BK	Unit 3
M1 M2	41 16	Y-BL BL-Y	

Table 16
NT5K83 E&M 2-Wire Paging trunk connections

Lead designations	Pins	Pair color	Unit number
T0 R0	27 2	W-O O-W	Unit
A PG	29 4	W-BR BR-W	0
T1 R1	31 6	R-BL BL-R	Unit
A PG	33 8	R-G G-R	1
T2 R2	35 10	R-S S-R	Unit
A PG	37 12	BK-O O-BK	2
T3 R3	39 14	BK-BR BR-BK	Unit
A PG	41 16	Y-BL BL-Y	3

Table 17
NT5K83 E&M 2-wire Recorded Announcement trunk connections

Lead designations	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
SIG B SIG A	29 4	W-BR BR-W	
T1 R1	30 5	W-S S-W	Unit 1
SIG B SIG A	33 8	R-G G-R	
T2 R2	34 9	R-BR BR-R	Unit 2
SIG B SIG A	37 12	BK-O O-BK	
T3 R3	38 13	BK-G G-BK	Unit 3
SIG B SIG A	41 16	Y-BL BL-Y	

Table 18
NT5K83 E&M 4-Wire Type 1 and Type 5 (BPO) connections

Lead designations	Pins	Pair color	Unit number
TA TB	26 1	W-BL BL-W	Unit 0
RA RB	27 2	W-O O-W	
E M	28 3	W-G G-W	
TA TB	30 5	W-S S-W	Unit 1
RA RB	31 6	R-BL BL-R	
E M	32 7	R-O O-R	
TA TB	34 9	R-BR BR-R	Unit 2
RA RB	35 10	R-S S-R	
E M	36 11	BK-BL BL-BK	
TA TB	38 13	BK-G G-BK	Unit 3
RA RB	39 14	BK-BR BR-BK	
E M	40 15	BK-S S-BK	

Table 19
NT5K83 E&M 4-Wire Type 2 trunk connections

Lead designations	Pins	Pair color	Unit number
RA RB	26 1	W-BL BL-W	Unit 0
TA TB	27 2	W-O O-W	
E1/E2 M!/M2	28 / 3 29 / 4	W-G / G-W W-BR / BR-W	
RA RB	30 5	W-S S-W	Unit 1
TA TB	31 6	R-BL BL-R	
E1/E2 M!/M2	32 / 7 33 / 8	R-O / O-R R-G / G-R	
RA RB	34 9	R-BR BR-R	Unit 2
TA TB	35 10	R-S S-R	
E1/E2 M!/M2	36 / 11 37 / 12	BK-BL / BL-BK BK-O / O-BK	
RA RB	38 13	BK-G G-BK	Unit 3
TA TB	39 14	BK-BR BR-BK	
E1/E2 M!/M2	40 / 15 41 / 16	BK-S / S-BK Y-BL / BL-Y	

Table 20
NT5K83 E&M 2280 Hz Tie trunk connections

Lead designations	Pins	Pair color	Unit number
TA TB	26 1	W-BL BL-W	Unit 0
RA RB	27 2	W-O O-W	
TA TB	30 5	W-S S-W	Unit 1
RA RB	31 6	R-BL BL-R	
TA TB	34 9	R-BR BR-R	Unit 2
RA RB	35 10	R-S S-R	
TA TB	38 13	BK-G G-BK	Unit 3
RA RB	39 14	BK-BR BR-BK	

Self-test

When the NT5K83DB E&M Tie trunk card is installed and power is applied to it, a self-test is performed on the card. The red LED on the NT5K83DB faceplate flashes three times, then remains continuously lit until the card is enabled in software. If the self-test fails, the LED will remain lit after the card is enabled.

Trunk configuration

Route Data Block

Each trunk unit on the NT5K83DB E&M trunk card is attached to a route with an associated route data block. The route data block is programmed in overlay 16.

Note: All prompts are defaulted except for those noted in Table 9. Default values are shown in brackets.

Table 21
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-511	Enter route number
TKTP	TIE, RAN, PAG	Define trunk type as Tie, Recorded announcement or Paging
ICOG	IAO	Incoming and Outgoing trunk
ACOD	XX	XX=Trunk route access code

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NT5K83DB E&M trunk card. Default values are shown in brackets.

Table 22
LD 14 Trunk Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	TIE, RAN, PAG	Trunk type Tie, (Recorded announcement), (Voice paging)
TN	CC UU	Terminal number of the unit: Card, Unit
XTRK (see note)	XFEM	Type is IPE XFEM
SIGL	EM4, EAM, WR4	4 wire E&M, 2-wire E&M, CEPT L1 signaling
—Table continued—		

Table 23
LD 14 Trunk Data Block

Prompt	Response	Comments
EMTY	TY1, (TY2)	Type 1 signaling, (Type 2)
STRI	IMM, WNK, DDL, SACK, PTSD	Incoming start Immediate, Wink, Delayed dial, Seize Ack, Proceed to send
STRO	IMM, WNK, DDL, SACK, PTSD	Outgoing start immediate, Wink, Delayed Dial, Seize ACK, Proceed to Send
SUPN	YES, (NO)	Answer and disconnect supervision
CLS	DTN, (DIP)	Digitone, (Digipulse)

Note: This prompt is required only for the first unit defined on each NT5K83DB card.

Technical description

Power requirements

Table 12 lists the power requirements for the NT5K83DB trunk card.

Table 24
NT5K83DB Power requirements

Voltage	Active Current
+/- 15.0 V dc	150 ma
+8.5 V dc	35 ma
+ 5 V dc	110 ma
-48 V dc	80 ma

Environmental specifications

Table 13 provides the environmental specifications for the NT5K83DB E&M Tie trunk card.

Table 25
NT5K83DB Environmental specifications

Parameter	Absolute Limit
Operating temperature	10 to 45 degrees C, ambient
Operating humidity	20 to 80% RH (non condensing)
Storage temperature	-20 to +60 degrees C

Transmission parameters

Pad settings are not required in Holland. Loss values for all modes of operation on the E&M trunk card are as follows:

Analog to Digital loss: 0.0 dB (plus or minus 0.5 dB)

Digital to Analog loss:-3.0 dB (plus or minus 0.5 dB)

Trunk types description

Each unit on the NT5K83DB E&M Tie trunk card supports:

- 2 wire E&M Type 1, Type II, Type V (BPO)
- 4 wire E&M Type 1, Type II, Type V (BPO)
- 2280 Hz Tie trunk
- Recorded Announcement (RAN) trunk
- Paging (PAG) trunk

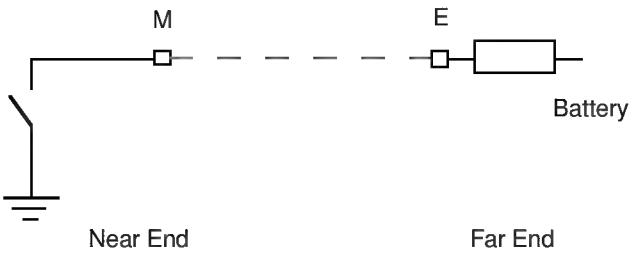
E&M trunk operation

The NT5K83DB E&M tie trunk supports Type I, Type II, and Type V methods of signaling.

Type I and Type V (BPO) E&M send and receive signals

Type I and Type V (BPO) E&M signaling use two signaling leads, E and M, that are electrically separated from the associated speech circuit. Signals are sent on the M lead and received on the E lead as shown in Figure 1. Earth is used for the signal return path.

Figure 1
E&M Type I and Type V (BPO) signaling



Send signals
In Type I mode, all signals are sent as either "Earth on" or "Battery on" applied to the M wire. Battery on consists of -48V applied to the M wire, Earth on is the application of ground to the M wire

In Type V (BPO) mode, all signals are sent as either "Earth on" or "Earth off" applied to the M wire. Earth off consists of open circuit applied to the M wire, Earth on is the application of ground to the M wire.

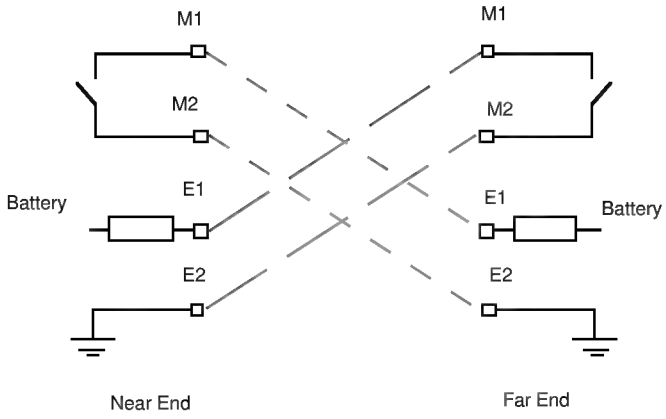
Receive signals
All signals are received as either "Earth on" or "Earth off" applied to the E wire, where:

- Earth on is the application of ground to the E wire through a resistance of up to 1500 ohms
- Earth off is the application of ground to the E wire through a resistance of up to 20 Kohms.

Type II E&M send and receive signals

Type II E&M operation uses two signaling pairs, E and M, that are electrically separated from the associated speech circuit. Signals are sent on the M pair and received on the E pair as shown in Figure 2.

Figure 2
E&M Type II signaling



Send signals

All signals are sent as either an "Open" or "Closed" condition applied to the M wire pair.

Receive signals

All signals are received as either an "Open" or "Closed" condition applied to the E wire, where:

- The Closed condition is a resistance of up to 2 Kohms applied to the E wire pair
- The Open condition is a resistance of greater than 20 Kohms applied to the E wire pair.

Type I, Type II and Type V signaling

Tables 14, 15, and 16 provide a summary of signaling states for Type I, Type II, and Type V signaling respectively.

Idle state

In the Idle state, the Option 11 applies an idle signal to the M wire to indicate that it is free to accept incoming calls.

Seize
To place an outgoing call, the Option 11 at the near end sends a seizing signal through the M lead to the far end. The incoming end recognizes the seize signal and prepares to receive digits.

Holding
The continued receipt of the seize signal is seen by the incoming end as a hold signal.

Dialing
The Option 11 sends digits through the M lead in the form of 10 pps of the open-circuit condition.

Answer
When the called party answers, the far end sends an "answer" signal through the M lead.

Call disconnect
Either party can disconnect the call by applying a clear signal to the M lead. The far end applies a "clear back" signal, while the near end applies a "clear forward" signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

Table 26
Summary of NT5K83DB Type I signaling states

Signal	Option 11 sending condition — M Wire	Option 11 receiving condition — E Wire
Idle	Earth on	Earth off
Seize	Battery on	Earth off
Hold	Continuation of seizing signal	Continuation of Earth On condition
Digit Pulse	Earth on pulses in step with dial pulses	—
Answer	Battery on	Earth on
Clear forward	Earth on for longer than 300 milliseconds	—
Clear back	—	Earth off for longer than 300 milliseconds

Table 27
Summary of NT5K83DB Type II signaling states

Signal	Outgoing PBX sending condition—M wire	Incoming PBX sending condition—M wire
Idle	Open	Open
Seize	Closed	—
Hold	Continuation of seizing signal	—
Digit Pulse	Open pulses in step with dial pulses	—
Answer	—	Closed
Clear forward	Open for longer than 300 milliseconds	—
Clear back	—	Open for longer than 300 milliseconds

Table 28
Summary of NT5K83DB Type V signaling states

Signal	Outgoing PBX sending condition—M wire	Incoming PBX sending condition—M wire
Idle	Earth off	Earth off
Seize	Earth on	—
Hold	Continuation of seizing signal	—
Digit Pulse	Earth off pulses in step with dial pulses	—
Answer	—	Earth on
Clear forward	Earth off for longer than 300 milliseconds	—
Clear back	—	Earth off for longer than 300 milliseconds

CEPT L1 2280 Hz trunk operation

The NT5K83DB E&M Tie trunk card supports the CEPT L1 method of signaling, which is used between two Private Branch Exchange (PBX) machines. The system is based on a single voice frequency (2280 Hz) method of signaling.

CEPT L1 2280 Hz send and receive signals

In this system, four signaling wires are used: one pair for forward signals and one pair for backward signals. The transmit pair through which signals are transmitted is the receive pair at the far end. All signals are in the form of either tone-on or tone-off. Table 17 provides a summary of signals in both transmit and receive directions.

Table 29
NT5K83DB tone-on and tone-off signaling

Signaling direction	Tone-On	Tone-Off
Transmit	Signaling tone of 2280 Hz +/- 5 Hz	Removal of the Signaling tone
Receive	Signaling tone of 2280 Hz +/- 15 Hz at a level between -4 dBm0 and 30 dBm0	Any frequency or combination of frequencies with total power less than -40 dBmO

Tone-on signals are received at two power levels, high and low, depending on the length of the tone. Table 18 summarizes tone-on power levels.

Table 30
NT5K83DB tone-on receive levels

Duration of tone	High/Low Tone-On	dB Level
less than 300 ms	High	-10 dBm0 +/- -1 dB
300 to 550 ms	High	-10 dBm0 +/- -1 dB
greater than 550 ms	Low	-20 dBm0 +/- 1 dB

2280 Hz signaling

Table 19 provides a summary of 2280 Hz signaling states.

Idle state

In the idle state, the PBX machines at both ends of the circuit apply an idle signal to indicate they are free to accept incoming calls.

Seize
To place an outgoing call, the outgoing PBX applies a seize signal to the signaling path. The PBX at the incoming end recognizes the seize signal, busies the circuit against outgoing calls, and prepares to receive digits.

Dialing
The outgoing PBX sends address digits in the form of 10 pps of signaling tone (2280 Hz). Dual Tone Multifrequency (DTMF) digits can also be used.

Answer
When the called party answers, the incoming PBX applies an answer signal to the signaling path.

Hold
The continued receipt of the seizing signal is accepted by the incoming PBX as a forward hold signal. The continued receipt of the answer signal is accepted by the outgoing PBX as a backward hold signal.

Call disconnect
Either party can disconnect the call by applying the appropriate signal. The incoming PBX applies a "clear back" signal, while the outgoing PBX applies a "clear forward" signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

Table 31
Summary of NT5K83DB 2280 Hz signaling states

Signal	Outgoing PBX	Incoming PBX
Idle	Tone-on	Tone-on
Seize	Tone-off	—
Forward Hold	Tone-off	—
Dialing	Tone-on pulses corresponding to digit signal sent	—
Answer	—	Tone-off
Backward Hold	—	Tone-off
Clear Forward	Tone-on for longer than 300 ms	—
Clear Back	—	Tone-on for longer than 300 ms

CEPT L1 signaling

Table 20 provides a summary of L1 signaling states.

Release 20 software onward

Table 32
Summary of NT5K83DB L1 signaling states

Signal	Outgoing PBX	Incoming PBX
Idle	Tone-on	Tone-on
Seize	Tone-off	—
Seize acknowledge		Tone-off
Proceed-to-send		
Answer		Single tone-on pulse
Clear Forward	Tone-on	
Clear Back		Tone-on
Cleared signal		Tone-on
Forward-ser RRC	Single tone-on pulse	—
Backward-ser RRC		Single tone-on pulse
Intrusion	Single tone-on pulse	
End-of- intrusion	Single tone-on pulse	
Forward-link-recall	Double tone-on pulse	—
Backward-link-recall	—	Double tone-on pulse

Recorded Announcement trunk operation

When used in the Recorded Announcement mode, the trunk circuit is connected to a customer provided recorded announcement machine or a music source.

The NT5K83DB E&M Tie trunk card supports the following types of announcement machines:

- Start mode announcement machines
- Continuous mode announcement machines

Recorded announcement machines supported include the Cook Digital 4-channel announcer and the Audichron HQI-112.

Start mode

In start mode, the E&M Tie trunk card provides a startpulse to the announcement machine to begin playback of the message. The announcement source requires the following:

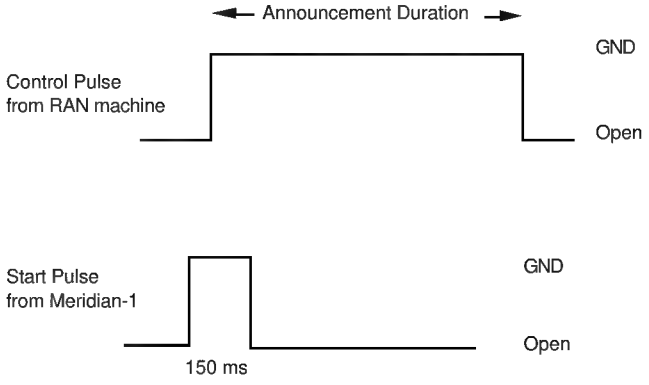
- an impedance of 4 ohms or less
- ground to the trunk unit when playing and an open circuit when idle. This is done through a control lead to the trunk circuit.
- default signal level of -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

To start the announcement, the NT5K83DB E&M Tie trunk card provides a momentary ground signal (150 ms) to the source. The announcement machine should then start playing its message.

The NT5K83DB trunk card expects status information from the announcement machine, that is, whether it is idle or playing. For this reason, the announcement machine requires a control lead to the trunk circuit.

Figure 3 shows recorded announcement in start mode.

Figure 3
Recorded announcement - start mode



Continuous mode

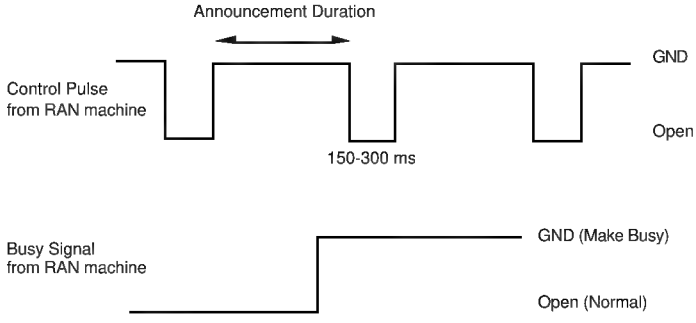
The requirements for continuous mode announcement machines are as follows:

- an impedance of 4 ohms or less
- generation of a control pulse (150 - 300 ms) at the start of the announcement period
- default signal level of -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

The announcement machine may provide a separate busy signal when the machine is recording or erasing a message or if the machine is malfunctioning. The busy signal will be used by the Option 11 for maintenance purposes.

Figure 4 shows recorded announcement in continuous mode.

Figure 4
Recorded announcement - continuous mode



Music source

The music source should provide an impedance of 600 Ω. The default signaling level should be -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

Paging trunk operation

When used in the paging mode, the trunk circuit is connected to a customer-provided paging amplifier system. When accessed, the card provides a loop closure. In a typical application, the loop closure will cut off a music supply and switch the paging trunk transmission path to the paging amplifier.

Flexible analog line circuit card

Functional description

The Flexible analog line card provides an interface for up to 16 analog (500/2500-type) telephones lines. It can be installed in slots 1-10 in the Option 11 main cabinet and in any slot in the expansion cabinet.

There are two types of Flexible Analog Line cards available for use in Holland:

- the NT5K02KA line card with message waiting
- the NT5K96KA line card without message waiting.

Common features

Both Flexible Analog line cards provide the following features:

- support of digipulse or digitone telephones
- telephone on-hook and off-hook detection based on loop current
- ground button detection
- relay for connecting an ac ringing signal
- collection of dial pulses (10 and 20 pps) from 500-type telephones
- analog to digital and digital to analog conversion for 16 analog telephone lines
- terminating impedance of 600 ohms

- software selectable A-Law or μ-Law companding
- provision of line current to telephones. Line current is limited on short loops or under fault conditions. Otherwise, current varies according to loop length to allow automatic gain compensation.

Physical description

Switch settings

There are no option switches on the Flexible Analog line card. All settings are configured in software.

Connections

The Flexible Analog line card has 16 units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal. At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Faceplate LED

The faceplate of the NT5K02KA and NT5K96KA are equipped with a red LED which lights when all the assigned units on the circuit card are disabled.

Technical description

Power requirements

Table 1 lists the power requirements for Flexible Analog line card.

Table 33
NT5K02KA and NT5K96KA power requirements

Voltage	Idle current	Maximum current (all units active)
+15.0 V dc	120 ma	120 ma
-15.0 V dc	24 ma	24 ma
+ 8.5 V dc	250 ma	280 ma
-48.0 V	0 ma	320 ma
- 48.0 V dc	60 ma	700 ma
Ring V ac	0 ma	160 ma (See note)

Note:

This figure reflects 10 ma for ringing one telephone per unit. There may be more than one telephone or ringer on a unit.

Environmental specifications

Table 2 lists the environmental specifications of the Flexible Analog line card.

Table 34
NT5K02KA and NT5K96KA environmental specifications

Parameter	Specifications
Operating temperature	0 to 45 degrees C, ambient
Operating humidity	5 to 95 % Relative Humidity
Storage temperature	- 40 to + 70 degrees C

Signalling

Loop operation

The Flexible Analog Line Card is loop start, with a loop limit of 1300 Ω at -48 V including the telephone set. The minimum and maximum values of current feed are 29 ma to 40 ma respectively. A resistance of more than 10 kohm is recognized as an idle or release signal.

Table 3 lists the number of telephone sets that can be supported by the loop.

Table 35
Loop limits

Loop resistance including telephone sets	Number of telephone sets
350 Ω or less	2
Over 350 Ω to a maximum of 1300 Ω	1

Ringers

A maximum of 5 NE-C4A ringers can be supported on one unit. Ringing is supplied to the telephones at a frequency of 25 Hz at a voltage of 86 Vrms. The peak voltage is no higher than 125V.

Message waiting indicator

The message waiting indicator consists of a lamp flashing at a rate of 1 Hz at the telephone set. (A continuously lit lamp as a message indicator is not provided). The lamp is activated as a result of a reversal of the Tip and Ring leads.

Digipulse dialing

The Flexible Analog line card collects all digits of 7-13 pps.

Ground button detection

The ground button detector sends a recall signal 30 to 50 ms after the application of a ground on either the Tip or Ring of the line. The loop resistance to the ground signal can be between 0 and 500 Ω.

The ground must be applied for a time greater than the minimum hookflash time. This time is downloaded from software and is known as the ground button validation time.

Transmission parameters

Loss values for the NT5K02KA and NT5K96KA Flexible Analog Line cards are as follows:

Analog to Digital loss: 0.0 dB +/- 0.5 dB

Digital to Analog loss:+7.0 dB +/- 0.5 dB

Meridian 1

Intelligent peripheral equipment circuit cards for Holland

Option 11 - Description and Installation

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